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ANDREW C. LAWSON, Editor

Note on Two Tertiary Faunas

FROM

THE ROCKS OF THE SOUTHERN COAST OF
VANCOUVER ISLAND

BY

J. C. Merriam



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NOTE

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ROCKS OF THE SOUTHERN COAST OF VANCOUVER ISLAND

BY

J. C. MERRIAM.

CONTENTS.

Introductory Remarks.....	101
Carmanah Point.....	102
Occurrence of Fossils.....	102
List of Species.....	103
Correlation.....	104
Sooke District.....	105
Table of Sooke Fauna.....	105
Age and Relationship of Fauna.....	106

INTRODUCTORY REMARKS.

THE occurrence of fossiliferous horizons of marine Tertiary on the coast of Vancouver Island having received only the briefest mention in geological literature, the following description of some interesting collections recently made on the southern coast of the island by Dr. C. F. Newcombe, of Victoria, is offered as a contribution to our knowledge of the geology and palæontology of this region.

During the years 1894 and '95 several collections of marine Tertiary shells from Vancouver Island were forwarded to the writer

by Dr. Newcombe for identification and for determination, if possible, of the age of the rocks in which they occur. The collections were all from two localities, representing different horizons of the Tertiary. The first of these is on Carmanah Point at the entrance to the Strait of Fuca, and the second near Muir and Coal Creeks, in the Sooke District. All the material was collected by Dr. Newcombe, who visited the localities, collecting fossils and studying, where possible, the stratigraphic relations of the fossiliferous beds. Up to the time of Dr. Newcombe's explorations the Tertiary fossils of Vancouver Island seem never to have been systematically collected.

CARMANAH POINT.

The collection from Carmanah Point represents the older of the two horizons, and is interesting on account of the resemblance it bears to the fauna of Conrad's Astoria Miocene,* to the greater, Miocene portion of which Dr. W. H. Dall† has given the name Astoria Group.

Occurrence of Fossils.—A section of the rocks near Carmanah Point lighthouse, forwarded to the writer by Dr. Newcombe, shows altogether about 150 feet of sandstone, shale, conglomerate and drift mantle. The occurrence of the fossils is described by Dr. Newcombe in the following note:—

"The fossils are found chiefly in the conglomerate layers, mostly in the contained boulders, which vary in size from small pebbles to four or five feet in diameter. The boulders, when fossiliferous, are of a bluish grey, fine, and very hard sandstone. The matrix of the conglomerate contains in places large quantities of broken fragments of shells, many resembling species in the boulders, but mostly too much broken up to permit identification. Several large pieces of bored fossil wood project in various parts of the section. Similar rocks extend east and west for some miles, but are very difficult of access except in very calm weather."

Dr. Newcombe's statement that the matrix between the fossiliferous boulders contains "broken fragments of shells, . . . resembling species in the boulders," suggests the idea that the boulders are of concretionary origin. This seems all the more probable as

*Geology of Wilke's Exploring Expedition, 1838-42.

†Correlation Papers, Neocene. Bull. 84, U. S. Geol. Surv., p. 225.

the occurrence of fossils in concretionary boulders is not uncommon at Astoria and at various other points on the west coast, where the later Tertiary rocks are exposed. In answer to a question as to the character of the fossiliferous boulders, Dr. Newcombe stated recently that it is possible that they are concretionary, but he remembers having seen along with them, in the fossiliferous beds, large quartz and diorite pebbles and water-worn boulders. Whether water-worn or concretionary, it is pretty certain that the fossiliferous boulders are all of the same origin, since the matrix in which the fossils are imbedded seems to be the same in all cases. We may safely assume that the species cited here as occurring in the Carmanah Point beds all belong to the same fauna, which may have flourished *in situ* at the time the Carmanah Point sediments were being deposited, or may have lived in an earlier period, at a locality not far distant, from which the fossiliferous boulders were derived for the formation of the Carmanah Point conglomerate.

List of Species.—The following species* from Carmanah Point were identified in Dr. Newcombe's collection.

1. *Nucula divaricata*, Con.
2. *Doliopsis* sp.
3. *Lucina acutilineata*, Con.
4. *Mya abrupta*, Con.
5. *Tellina oregonensis*, Con.
6. *Crepidula rostralis*, Con.
7. *Dentalium substriatum*, Con.
8. *Cerithiopsis oregonensis*, Con.
9. *Priscofusus oregonensis*, Con.
10. *Cardita ventricosa*, Gld.
11. *Tellina albaria*, Con.
12. *Lunatia oregonensis*, Con.
13. *Sinum scopulosum*, Con. (*conf.*).
14. *Cylichna oregona*, Con.
15. *Pectunculus patulus*, Con.
16. *Loripes parilis*, Con.

*The synonym of the species listed, together with descriptions and figures of the new species, will form the subject of a future paper.

17. *Cytherea vespertina*, Con. (*aff.*).
18. *Trochita inornata*, Gabb. (*aff.*).
19. *Mytilus edulis*, Linn. (*aff.*).
20. *Turritella* nov. sp.
21. *Cardium* nov. sp.
22. *Cytherea* sp.
23. *Solen* sp.

24. Bored wood, *Teredo* (?) sp.

In addition to this list Dr. Newcombe has sent the following list of species, determined by Dr. W. H. Dall, in a collection made near Carmanah Point in 1890.

1. *Axinus bisectus*, Con.
2. *Chrysodomus* sp. (found in Oregon Miocene).
3. Veneroid (possibly *Clementia*).
4. *Macoma nasuta*, Con.
5. *Venus pertenuis*, Gabb.
6. *Pachypoma biangulata*, Gabb. (*conf.*).
7. *Mytilus edulis*, Linn. (*aff.*).
8. *Pleurotoma* indet.
9. *Teredo* sp.

Correlation.—Of these species numbers 1–17 of the writer's list occur in Conrad's Astoria Miocene, *Trochita inornata* (No. 18) and forms like *Mytilus edulis* (No. 19) occur in the Miocene of California, Nos. 20 and 21 are new, and the other three forms are doubtful.

Of Dr. Dall's list the *Axinus bisectus* and *Chrysodomus* occur at Astoria. A *Clementia*-like shell, which was seen in Dr. Newcombe's collection, looked very much like *Cytherea oregonensis*, Con., found originally near Astoria. *Macoma nasuta*, *Venus pertenuis* and forms like *Mytilus edulis*, are found in the Miocene of California. *Pachypoma biangulata* occurs in rocks of doubtful age (Neocene) in California. The species of *Teredo* and *Pleurotoma* not being identified, need not be considered farther.

The fauna of the Carmanah Point beds seems, on the whole, to be the same as that of Conrad's Astoria Miocene, excluding, however, the lower portion of the latter series, which has been supposed to be of Eocene age.

Sooke District.

In 1876 Mr. James Richardson noticed the occurrence of fossiliferous rocks in the Sooke District, and published the following statement regarding them.*

"At the mouth of John's River the lowest beds are grey sandstone, in some places crowded with fossils belonging apparently to three or four species. These are referable to the genera *Ostrea*, *Pecten*, and *Saxidomus* and are either of Tertiary or post-Tertiary age."

In 1892 Dr. W. H. Dall mentioned† the occurrence of marine beds of Miocene age near Sooke.

Dr. Newcombe visited the Sooke District in 1893, '94, and '95, collecting in all between twenty-five and thirty molluscan species.

The cliffs, in which the fossils occur, are stated by Mr. Richardson and Dr. Newcombe to show a considerable thickness of soft sandstone, with some conglomerate. The strata do not appear to be greatly disturbed. In places the sandstone is full of fossils, which are often well preserved.

Table of Sooke Fauna.—The following table of species gives, as nearly as can at present be determined, the composition of the fauna of the Sooke beds:—

*Geol. Surv. of Canada Rept. Prog. 1876-77.

†Bull. U. S. Geol. Surv., No. 84, p. 230.

	Recent.	Pliocene, Calif.	Miocene, Calif.	Miocene, Astoria or Carmichael Pt.	Extinct.
1. <i>Placunanomia macroschisma</i> , Desh.....	*	*	*	*	*
2. <i>Mytilus edulis</i> , Linn.....	*	*	*	*	*
3. <i>Cerithidea californica</i> , Hald.....	*	*	*	*	*
4. <i>Acmea mitra</i> , Esch.....	*	*	*	*	*
5. <i>Crepidula rugosa</i> , Nutt. (<i>aff.</i>).....	*	*	*	*	*
6. <i>Pecten aequisulcatus</i> , Carp. (<i>conf.</i>).....	*	*	*	*	*
7. <i>Pecten hastatus</i> , Sowb. (<i>conf.</i>).....	*	*	*	*	*
8. <i>Chrysodomus dirus</i> , Reeve.....	*	*	*	*	*
9. <i>Yoldia impressa</i> , Con.....	*	*	*	*	*
10. <i>Pectunculus patulus</i> , Con.....	*	*	*	*	*
11. <i>Trochila inornata</i> , Gabb.....	*	*	*	*	*
12. <i>Sinum scopulosum</i> , Con. (<i>conf.</i>).....	*	*	*	*	*
13. <i>Fusus</i> nov. sp. (a).....	*	*	*	*	*
14. <i>Fusus</i> nov. sp. (b).....	*	*	*	*	*
15. <i>Patelloid</i> nov.....	*	*	*	*	*
16. <i>Nassa</i> (?) nov. sp.....	*	*	*	*	*
17. <i>Ancillaria</i> nov. sp.....	*	*	*	*	*
18. <i>Cytherea</i> nov. sp. (a).....	*	*	*	*	*
19. <i>Cytherea</i> nov. sp. (b).....	*	*	*	*	*
20. <i>Bittium</i> nov. sp. (?).....	*	*	*	*	*
21. <i>Crepidula</i> sp.....	*	*	*	*	*
22. <i>Ostrea</i> sp.....	*	*	*	*	*
23. <i>Cardium</i> sp.....	*	*	*	*	*
24. <i>Cerithidea</i> sp.....	*	*	*	*	*
25. <i>Tapes</i> (?) sp.....	*	*	*	*	*

Age and Relationship of Fauna—In attempting to determine the age of the Sooke beds, a comparison of their fauna with that now existing on the Pacific Coast shows that of the twenty molluscan species determined, eleven, or about fifty-five per cent, are probably extinct, and eight or nine are pretty certainly living. Five species could not be certainly determined and should not be considered. According to the law of percentages as generally used in determining the age of Tertiary faunas, the nearly equal number of living and extinct species makes it impossible to place the beds in either the Eocene or Quaternary. The number of species listed being small, we can not place much dependence in the percentage of living species for accurate determination of the age; it is hardly probable, however, that the Miocene would contain forty-five per cent. of living species, that number indicating a period nearer the present time.

Regarding the trustworthiness of the percentage method as

applied to west coast geology, even when the number of species at hand is large, it may be stated that, while it is certainly of great value where once standardized, it is doubtful whether the percentages of Recent molluscan species found in the faunas of the different Tertiary periods in other parts of the world would correspond at all to the percentages of modern forms, which existed on the west coast during the same periods. Corresponding to variations, or lack of variation, in topography and climatic conditions, the average percentage of Recent species on the west coast in any given period may have been much larger or much smaller than elsewhere.

Comparing the Sooke fauna with that of well-known Tertiary and post-Tertiary horizons of the Pacific Coast, we find that six or seven of the species are known from the Miocene and about an equal number from the Pliocene, nine species are found in the Quaternary and Recent, and seven or eight are not known to occur elsewhere, either recent or fossil.

The fauna of the Sooke beds, as represented in Dr. Newcombe's collection, is quite different from any of the Oregon or California Miocene or Pliocene faunas known to the writer. The presence of such a large percentage of new forms, and the decided difference of the whole fauna from that of Carmanah Point, of Astoria and of the lower Pliocene of Northern California, are rather surprising when we take into consideration the relation of these faunas to each other. There are common to the Carmanah Point and Sooke beds about five species; two good and three doubtful. This is a much smaller number than we should expect to find if both horizons belong to the Miocene or even if one were lower Miocene and the other lower Pliocene. This may be explained either by supposing the interval between the deposition of the original sediments containing the Carmanah Point fauna and the deposition of the Sooke beds to have been a very long one, allowing time for radical faunal changes, or by supposing considerable topographic and climatic changes to have taken place in a shorter interval, accompanied by immigration of new forms.

Supposing the Carmanah Point and Sooke faunas to have lived at different periods along the shore of the same ocean, we can hardly suppose the latter derived from the Carmanah Point fauna by

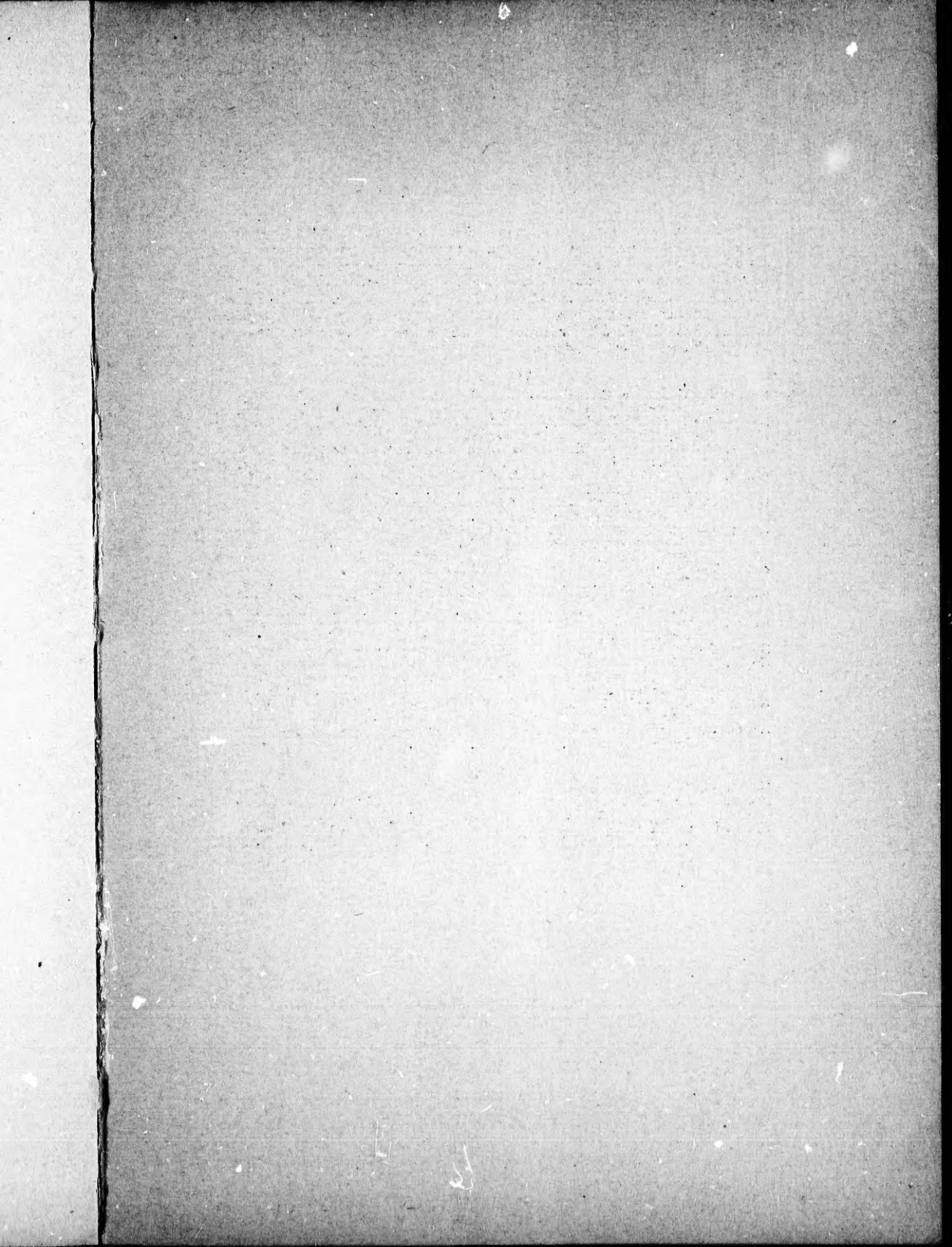
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gradual process of evolution within the limits of the middle Tertiary. Immigration and emigration must have been important factors in the change. Granting even that the greater part of the change was due to migration rather than evolution, the faunal changes, together with the climatic or topographic changes which they must necessarily have accompanied, are such as usually mark the boundaries between geological periods.

The evidence at our command indicates that the Sooke beds are of middle Neocene age, and that the time of their deposition was considerably later than that of the Carmanah Point beds.

University of California, Dec. 1, 1896.

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